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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte WALTER H. WHITLOCK

Appeal 2009-002740
Application 10/643,597
Technology Center 1700

Decided:¹ June 08, 2009

Before EDWARD C. KIMLIN, PETER F. KRATZ, and LINDA M.
GAUDETTE, *Administrative Patent Judges*.

KRATZ, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the
Examiner's final rejection of claims 1-20. We have jurisdiction pursuant to
35 U.S.C. § 6.

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the Decided Date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

Appellant's claimed invention is directed to a method and apparatus for cleaning a semiconductor wafer surface using, *inter alia*, a dense gas component, a liquid component, and a bellows accumulator.

Claims 1, 11, and 13 are illustrative and reproduced below:

1. A process for cleaning a surface of a semiconductor wafer, which comprises:

providing a wafer;

conveying a component selected from the group consisting of: a dense gas component, a liquid component and a mixture thereof to a bellows accumulator having a bellows therein;

applying an elevated pressure to said bellows sufficient to discharge said component from said bellows onto said surface of said wafer; and

contacting said component with said surface of said wafer to clean said wafer.

The Examiner relies on the following prior art references as evidence in rejecting the appealed claims:

Carney	6,076,557	Jun. 20, 2000
Barton	6,085,762	Jul. 11, 2000
De Young	2002/0112747 A1	Aug. 22, 2002
Nishio	6,612,818 B2	Sep. 02, 2003

The Examiner maintains the following grounds of rejection:

I. Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over DeYoung, Nishio, and Carney; and

II. Claims 1-2, 5, and 8-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Barton in view of Nishio and Carney.²

We affirm the stated rejections as set forth in the Examiner's Answer. Our reasoning follows.

Rejection over DeYoung, Nishio, and Carney

Appellant argues: claims 1-5 and 13 as a first claim grouping; claims 6 and 7 as a second claim grouping; and claims 8-12 and 14-20 as a third claim grouping (App. Br. 22). We select claims 1, 6, and 8, respectively, as the representative claims for these separately argued claim groups.

Concerning representative claim 1, Appellant argues that employing (combining) the bellows type pump of Nishio with DeYoung's cleaning method and system would not have been suggested [to one of ordinary skill in the art] based on the teachings of Nishio, DeYoung and Carney because Nishio is directed to low (elevated) pressure situations (App. Br. 21-22). Appellant asserts that using the bellows device of Nishio in combination with DeYoung would have rendered the high pressure DeYoung process and apparatus inoperable, and the addition of Carney as proposed by the Examiner does not alter this asserted outcome (*id.*).

Concerning representative claim 6, Appellant further argues that the Examiner's evidence falls short of establishing that the claimed cleaning component mixture velocity would have been "well known" or a "matter of

² Appellant refers to two other obviousness rejections (DeYoung in view of Nishio and Barton in view of Nishio) maintained by the Examiner in the Final Office action. *See* page 14 of the Amended Appeal Brief filed September 07, 2007 (App. Br. 14). The Examiner does not present these rejections in the Examiner's Answer dated December 07, 2007. Accordingly, we consider these rejections as having been withdrawn by the Examiner.

common knowledge” (App. Br. 22). With regard to claims 8-12, and 14-20, Appellant additionally contends that the applied references do not contemplate the use of two accumulators (bellows accumulators) as required.³

PRINCIPAL ISSUE

Has Appellant established reversible error in the Examiner’s obviousness rejection over DeYoung, Nishio, and Carney by the assertion that combining Nishio and Carney together with DeYoung would not have suggested the use of one or more bellows accumulators in the method/system of DeYoung?

PRINCIPLES OF LAW

On appeal to this Board, Appellant must show that the Examiner erred in rejecting the claims. *Cf. In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006); *see also* 37 C.F.R. § 41.37(c)(1)(vii).

During examination of a patent application, pending claims are given their broadest reasonable construction consistent with the specification. *In re Prater*, 415 F.2d 1393, 1404-05 (CCPA 1969); *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004).

³ Appellant generically presents arguments for several possible sub-groupings of claims using “for example” designations that do not delineate the precise claims intended to be included, and premises the argument on the lack of a suggestion of using more than one accumulator based on the applied combined references teachings, which argument is, in effect, the same argument made for the separate patentability of claim 8 (App. Br. 22-23). Thus, we do not consider this unfocused commentary as representing a separate argument for the patentability of any other properly identified sub-grouping of claims.

The Supreme Court has instructed that although the teaching, suggestion, and motivation test “captured a helpful insight,” an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

The Federal Circuit recently emphasized that “[a]n obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of a case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not.” *Leapfrog Enter., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007).

“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR*, 550 U.S. 398 at 416. The question to be asked is “whether the improvement is more than the predictable use of prior art elements according to their established functions.” *KSR*, 550 U.S. at 417.

A rejection premised upon a proper combination of references cannot be overcome by attacking the references individually. *In re Keller*, 642 F.2d 413, 426 (CCPA 1981). “[A] finding that the prior art as a whole suggests the desirability of a particular combination need not be supported by a finding that the prior art suggests that the combination claimed by the patent applicant is the preferred, or most desirable, combination.” *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004).

It is axiomatic that admitted prior art (APA) in an applicants' Specification may be used in determining the patentability of a claimed

invention and that consideration of the prior art cited by the Examiner may include consideration of the admitted prior art found in an applicant's Specification. *In re Nomiya*, 509 F.2d 566, 570-571 (CCPA 1975); *In re Davis*, 305 F.2d 501, 503 (CCPA 1962); *In re Hedges*, 783 F.2d 1038, 1039-1040 (Fed. Cir. 1986).

FINDINGS OF FACT

Appellant acknowledges that cleaning processes for wafers and electronic chips commonly employ a mixture of organic solvents and dense gases (e.g.; carbon dioxide) at high pressures (Spec. 1). Appellant acknowledges that “[c]arbon dioxide is typically supplied commercially as a compressed gas (liquefied) or as a cryogenic liquid” (Spec 6).

Appellant acknowledges the commercial availability of bellows accumulators, such as the HYDROPADTM brand by Flexicraft Inc. (Spec. 7-8).

DeYoung teaches or suggests a method and system for cleaning micro-electronic devices, such as semiconductor substrates (silicon dioxide wafers) using densified (liquefied or supercritical fluid) carbon dioxide in an admixture with an organic co-solvent under high pressure (¶¶ 0014, 0040, 0041, 0043-0045, and 0054; Figs. 2 and 4). DeYoung discloses the use of storage tanks or pressure vessels for holding the carbon dioxide and organic co-solvent cleaning agent under pressure for supply to the cleaning chamber under pressure and so as to direct the cleaning agent with “substantial fluid action onto the surfaces of the wafer” (¶ 0063; Fig. 4).

Appellant incorporates DeYoung (US 2002/0112747 A1) by reference into the subject Specification for disclosing a known wafer

cleaning process of the type Appellant is concerned with (para. bridging Spec. 8-9). Furthermore, Appellant does not dispute that DeYoung's process corresponds to the representative claim 1 process but for the use of a bellows accumulator for conveying a carbon dioxide or liquid cleaning component onto a wafer surface to be cleaned (*see generally* App. Br.).

Nishio teaches or suggests a bellows type pump/accumulator that is disclosed as being useful for the supply of liquid chemicals for washing surfaces of semiconductor devices with a smooth (reduced pulsation) discharge (col. 1, l. 9 - col. 2, l. 19).

Carney teaches or suggests that accumulators including bellows can be used in high pressure fluid supply lines for dampening pressure fluctuations (col. 2, ll. 15-62 and col. 4, ll. 23-60).

Appellant discloses that a useful accumulator for the subject claimed system and process can take many forms, including that of a storage tank, process vessel or bellows type, such as the known HYDROPADTM brand by Flexicraft Inc. (Spec., para. bridging 7-8).

ANALYSIS

Representative claim 1 is drawn to a process requiring the provision of a wafer, conveying a cleaning component comprising a liquid or dense gas component and discharging that component with any applied elevated pressure onto a surface of the wafer so as to clean the wafer. Appellant does not dispute that DeYoung teaches or suggests a wafer cleaning process corresponding to the above-noted aspects of the claim 1 process.

Representative claim 1 further requires use of a bellows accumulator. The Examiner and Appellant are in agreement that DeYoung does not

explicitly describe using such a bellows accumulator in the cleaning component conveyance path and applying elevated pressure via the bellows to discharge the cleaning component onto the wafer surface, as required by appealed representative claim 1.

However, both Nishio and Carney disclose bellows accumulators to be known devices used in conveying fluids under pressure, as noted above and in the Examiner's Answer. According to Carney, these bellows type accumulators can be used to dampen pressure fluctuations, as explained above. Also, Nishio teaches or suggests the use of bellows type pumps for supplying liquid chemicals to wash semiconductor devices. Of course, as also noted above, Appellant acknowledges the commercial availability of a bellows accumulator useful for the here-disclosed cleaning process.

Against this backdrop, Appellant's unadorned arguments, alleging a lack of suggestion for one of ordinary skill in the art to use these familiar and conventional bellows-type elevated or high pressure fluid supply devices for supplying the cleaning component in the process of DeYoung, are without merit. After all, Appellant has not demonstrated that the application of known bellows accumulators to the process of DeYoung is beyond the realm of predictability to one of ordinary skill in this art of cleaning semi-conductor wafers. An ordinarily skilled artisan is not without some measure of ordinary creativity and common sense so as to recognize the obviousness of employing such a conventional device for its intended purpose. *See KSR*, 550 U.S. at 417.

As for Appellant's unproven assertion that application of a bellows accumulator to the process of DeYoung would render the DeYoung process inoperative, suffice it to say that Appellant has not proffered persuasive

evidentiary support that substantiates this argument. In this regard, Appellant asserts Nishio's bellows can not be employed at the high pressure employed by DeYoung but only at lesser elevated pressures (App. Br. 25-26). However, this argument represents unsubstantiated argument or conjecture, at least on this appeal record, and does not take into account the knowledge and level of skill in the art as further evidenced by Carney and Appellant's acknowledgement in the Specification concerning the availability of a high pressure bellows accumulator device. This additional evidence suggests that bellows accumulators are capable of operating at high pressures on the order of pressures disclosed by DeYoung and are readily available and within the ordinary skill of the art to employ in the process of DeYoung.

Concerning representative claim 6 and the argued minimum 10 cm/sec cleaning agent discharge flow rate, we note that DeYoung teaches or suggests directing the cleaning agent with "substantial fluid action onto the surfaces of the wafer" (¶ 0063), as was pointed out above. On this record, we agree with the Examiner's obviousness position because DeYoung's teachings would have reasonably led one of ordinary skill in the art to determine the optimum or workable cleaning agent fluid action by routine experimentation and arrive at workable cleaning agent discharge flow rates for contacting and cleaning the wafer. Here, Appellant has not demonstrated that providing any cleaning agent discharge flow rate greater than 10cm/sec would have been outside the reach of an ordinarily skilled artisan who was following the teachings of DeYoung to furnish "substantial fluid action onto the surfaces of the wafer[s]" during the cleaning process.

Regarding representative claim 8 and the use of two bellows accumulators as required thereby, DeYoung discloses the provision of more than one liquid or fluid cleaning agent for supply to the wafer cleaning chamber, as we noted above (DeYoung, ¶¶ 0044, 0045, 0054 and 0063; Figs. 2 and 4). Thus, it would have been obvious for one of ordinary skill in the art to employ more than one bellows accumulator in De Young's method/system.

CONCLUSION

Appellant has not established reversible error in the Examiner's obviousness rejection over DeYoung, Nishio, and Carney by the assertion that combining Nishio and Carney together with DeYoung would not have suggested the use of one or more bellows accumulators in the method/system of DeYoung.

Rejection over Barton, Nishio, and Carney

In this second obviousness rejection maintained by the Examiner in the Answer, the Examiner relies on Barton instead of DeYoung (as relied upon in the first stated rejection) for teaching or suggesting a wafer cleaning process substantially corresponding to the claimed process but for the employment of one or more bellows accumulators, as the argued claims variously require (Ans. 7).

Again, the Examiner relies on Nishio and Carney for teaching the use of bellows-type pumps/accumulators and the Examiner maintains that “[i]t would have been obvious for one [ordinarily] skilled in the art to use the

accumulator taught by Nishio instead of the ballast tank taught by Barton.”
(Ans. para. bridging 7-8).

Appellant argues the rejected claims as a group in asserting that the Examiner has presented no plausible or convincing line of reasoning for the Examiner’s proposed combination (App. Br. 23-24). Also, Appellant argues that the proposed combination of references would not have taught the use of two accumulators, which additional argument pertains to claims 8-12 and 14-20. Thus, claims 1, 2, 5 and 13 are a first claim grouping and claims 8-12, and 14-20 are a second claim grouping for which reasonably specific arguments are separately presented. We select claims 1 and 8, respectively, as the representative claims for these separately argued claim groups.

PRINCIPAL ISSUE

Has Appellant established reversible error in the Examiner’s obviousness rejection over Barton in combination with Nishio, and Carney based on the argument that there is no plausible or convincing line of reasoning that supports the Examiner’s proposed modification of Barton to include the use of one or more bellows accumulators for use in supplying one or more cleaning components to a wafer surface for cleaning?

FINDINGS OF FACT

In addition to the factual finds set forth elsewhere in this Opinion, we determine the following findings of fact by a preponderance of the evidence.

Barton discloses a method of cleaning wafers that includes the steps of providing a wafer, conveying at least one cleaning component under pressure to a vessel or tank (accumulator), and discharging the one or more

cleaning components onto a wafer surface for contacting the wafer surface and cleaning the wafer (col. 2, l. 21-37, col. 2, l. 65 - col. 3, l. 63, col. 4, l. 9-21, col. 6, l. 34-col. 7, l. 34; col. 12, ll. 37-40; Figs. 1 and 2). While the illustrated Figure 1 embodiment of Barton employs three ballast tanks (36, 38, and 40) for supplying pressurized cleaning fluid to a wafer cleaning chamber (54), Barton teaches or suggests that this embodiment is merely exemplary (col. 7, l. 31-34, Fig. 1). For example, Barton teaches employing a single ballast tank (21) in the Figure 2 embodiment (col. 11, l. 58-67, Fig. 2).

Appellant incorporates by reference Barton (U.S. Patent No. 6,085,762) in the subject Specification as an example of a circuit manufacturing process including substrate/wafer cleaning steps with which Appellant's system and process is disclosed as being useful (Spec. para. bridging 8-9).

ANALYSIS

For substantially similar reasons to those set forth above with respect to the Examiner's obviousness rejection over DeYoung, Nishio, and Carney, we are likewise not persuaded by Appellant's non-substantiated assertions that the Examiner's proposed modification of Barton to employ known bellows accumulators in place of other ballast or holding tanks for conveying and discharging the cleaning components of Barton to the wafer cleaning vessel would be inimical to the process and system of Barton.

Both Nishio and Carney disclose bellows accumulators are known devices used in conveying fluids under pressure, as noted above and in the Examiner's Answer. Nishio teaches or suggests the use of bellows type

pumps for supplying liquid chemicals to wash semiconductor devices. Of course, as also noted above, Appellant acknowledges the commercial availability of a bellows accumulator that is useful in the here-claimed cleaning process.

Appellant's arguments respecting a lack of suggestion for one of ordinary skill in the art to use a familiar and conventional bellows-type high pressure fluid supply device for supplying the cleaning component in the process of Barton is unfounded. Appellant has not demonstrated that the application of known bellows accumulators to the process of Barton is beyond the reach of an ordinary skilled artisan familiar with cleaning semiconductor wafers. *See KSR*, 550 U.S. at 417.

Nor has Appellant fairly explained how the provision of one or more bellows accumulator tanks in the cleaning fluid supply system of Barton for discharging the cleaning fluid onto a wafer, as suggested by Nishio, would operate to "defeat the purpose of the Barton system" as argued (App. Br. 24).

As for the arguments with respect to representative claim 8 and the use of two accumulators, such arguments are not persuasive for substantially the same reasons we set forth above with respect to the Examiner's first stated obviousness rejection.

CONCLUSION

Appellant has not established reversible error in the Examiner's obviousness rejection over Barton in combination with Nishio and Carney based on the argument that there is no plausible or convincing line of reasoning that supports the Examiner's proposed modification of Barton to

include the use of one or more bellows accumulators for use in supplying one or more cleaning components to a wafer surface for its cleaning.

ORDER

The decision of the Examiner to reject claims 1-20 under 35 U.S.C. § 103(a) as being unpatentable over DeYoung, Nishio, and Carney; and to reject claims 1-2, 5, and 8-20 under 35 U.S.C. § 103(a) as being unpatentable over Barton in view of Nishio and Carney is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(1)(v).

AFFIRMED

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